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PRACA DOKTORSKA

Analiza nośności i rysoodporności muru zabytkowego poddanego zginaniu w płaszczyźnie

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Summary

The implementation of the work was triggered by the technical and economic aspect of repairing cracks above the window lintels of a 19th-century tenement house in Olsztyn. The building's expertise indicated that the ceramic walls were quite expensive to be "stitched together" using the British method using stainless steel in the form of metallic spiral rods on epoxy resin mortar. The original solution consisted in reinforcing the cracked walls with composite rods made of glass fibers placed near the surface in support joints on a modified mortar. The main purpose of the research was to determine the effect of surface reinforcement of brick walls with GFRP rods placed in support joints on a modified mortar and surface reinforcement with FRCM mesh on their load-bearing capacity and deformability. An additional objective was to determine whether the GFRP composite rods with a diameter of 6 mm on the modified mortar meet the criterion of strength and scratch resistance in the repair of ceramic walls.

The main research was carried out using masonry elements historically similar to ceramic elements from different periods. They used Renaissance brick (R) obtained from the demolition of buildings near Pasłęk and Gothic brick (G) made with historical production methods in the factory in Gniew. A brick from the 1920s from the demolition of a building in Czeladź (N), erected in a period comparable to the construction of the historic housing estate "Nikiszowiec" in Katowice, was also obtained for the study. Experimental ceramic walls were modeled on the partitions of the mentioned estate, built for real-scale tests on a flexible beam of the test stand.

Chapter 3 presents the development of ceramic construction to modern times. Factors affecting the durability of brick buildings are briefly discussed. The achievements of scientists in the field of strengthening walls from the times of H. Hilsdorf to Ł. Drobec were systematized. The use of composite bars in construction is specified. In addition, the mechanism of the formation of scratches and cracks on ceramic walls was deepened. An original method of repairing a cracked wall with glass fiber composite rods using a modified mortar was proposed and it was determined whether the selected repair materials meet the strength requirements. It was assumed that the proposed materials have technical parameters similar to those of the materials used, e.g. in the conservation of monuments (method of repairing wall cracks with metallic spiral rods on epoxy resin).

For the Renaissance brick, the historical coefficient of $\kappa = 0.28$ was adjusted. This indicator met the standard data for calculating the average characteristic compressive strength of the wall and corresponded with the results of the compressive strength of the tested Renaissance bricks.

Chapter 4 analyzes the material tests of the main components used to reinforce ceramic walls. The construction of mortars was approximated with the presentation of scanograms of their structure seen under a microscope. Bricks from various historical periods were examined. The standard compressive and tensile strength of the mortars by bending was determined. Class standard tests from various periods were carried out in laboratory conditions. The properties of GFRP bars are also given. In the course of the research, a method of extracting a single "rovling" from a composite rod and determining its characteristic compressive strength was determined completely by accident.

Chapter 5 is devoted to standard tests of the compressive strength of walls for various models of walls built on test stands in the laboratory of the Faculty of Civil Engineering of the Silesian University of Technology in Gliwice. In the first stage of the research, standard walls were made in order to determine their class. Then, on the test stands, real-size models of two walls were built on the flexible beam, marking them as the C-1 model. and C-2. These models were subjected to a vertical load with simultaneous deflection of a flexible beam. On the walls, on both sides of the faces of the walls, measurement bases with PJX sensors were placed, enabling the recording of data from displacements. Observed scratches and cracks in C-1 models and C-2 documented in the form of drawings and photos. After the tests, the walls in question (modeled on partitions from the "Nikiszowiec" housing estate in Katowice) were strengthened and reloaded, giving them the designations - model C-1.1 and model C-2.1. Model C-1.1 defined a surface-reinforced wall using composite reinforcement in the form of FRCM mesh on a modified mortar. Model C-2.1 defined a ceramic wall reinforced near the surface with GFRP composite bars ø 6 located in the bearing joints above the arch and in the part of the broken lintel of the compression zone. This chapter describes the technology of wall reinforcement with the use of glass fiber composite rods on a modified mortar. The course of the tests is presented on computer-generated graphs for the angle of transverse deformation under deflection and load. The read data were summarized in tables and analyzed. The final conclusions from the research are presented in Chapter 6. The work is innovative in terms of the use of new materials in the repair of cracked walls, brick partitions in buildings that do not

require fire resistance. Carried out tests have shown that the reinforcements used in the repair of ceramic walls ensure the load capacity of the walls.